

ERB

DESIGN, DEVELOPMENT AND DELIVERY
OF 75-VA AND 100-VA INTEGRATED STATIC INVERTERS

MONTHLY REPORT NUMBER 17

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J. P. Vergez

L. L. Glover

L. A. Hahn

P. F. Newcomb

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Prepared by

TEXAS INSTRUMENTS INCORPORATED

Semiconductor-Components Division

Post Office Box 5012

Dallas, Texas 75222

For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

George C. Marshall Space Flight Center

Huntsville, Alabama 35812

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SECTION II

TECHNICAL DISCUSSION

A. Progress Report for Month of September, 1966

1. Summary

a. 75VA

The printed circuit board for the first production model inverter has been built and tested electrically over the entire temperature range.

A multiple package Johnson counter using SN5473 flip-flops was tried in the second breadboard with unsatisfactory results. Satisfactory results were obtained using SN5302 flip-flops however, and, with this Johnson counter, the second breadboard performed satisfactorily over the complete range of ambient temperatures.

Most of the month's effort in the power transistor area was utilized in building L-164's. New ceramics for the L-163 were delivered the last part of the month and a few L-163's were fabricated.

Exhaustive test and failure analysis have resulted in isolating a primary failure mode in the Johnson counter array. A modification to the photomasks used for one of the diffusions has been made. This mask change will correct this failure mode. New masks are due October 1.

b. 100VA

The block diagram and breadboard schematic are the same as reported last month.

Masks for the symmetrical PNP and the PNP darlington are now scheduled for shipment on October 1. Experimental diffusions are continuing as the process is being developed.

2. Progress Report on Subsections

a. Inverter System

(1) 75VA

Electrical evaluation of the second breadboard has been completed with satisfactory results. There are several differences between this second breadboard and the first breadboard now at Huntsville.

The schematic and wiring diagram and parts list of the second breadboard are shown in Figures 1 and A-1 respectively.

Figure 2 is a schematic of the series 53 Johnson counter which is being used in place of the single chip Johnson counter N2.

The differences between the two breadboards are as follows:

(1) Physical location of components are different. The second breadboard has a layout almost identical with that of the final systems.

- (2) The second breadboard uses a Johnson counter built from series 53 flip-flops instead of series 54. This was necessary in this second breadboard because satisfactory performance could not be obtained from the series 54.
- (3) Resistor R36 was changed from a 750Ω resistor to a 681Ω resistor. This lowers the supply voltage of the Johnson counter to between 4.5 to 5.0 volts which is more compatible with the series 53 flip-flop requirements.
- (4) The only other changes are in minor wiring details.

The plan is to have the production units modeled after the second breadboard.

The printed circuit board for the first production model was completed and was electrically tested over the entire ambient temperature range by connecting it into the second breadboard. Operation was satisfactory.

b. Power Transistors

(1) 75VA

Seventeen L-164's were built during the month and are now undergoing complete electrical evaluation. Eleven L-163's were also completed and tested yielding four devices within specs. Eighteen L-163's are on hand that have been through both electrical and mechanical testing and another seven are now being mechanically tested by QA.

(2) 100VA

See summary.

c. I/C Arrays(1) 75VA

Failure analysis of Johnson counter arrays showed that excessive voltage drops in the V_{CC} buss line was producing leaky junctions on resistor islands (as well as limiting the output current drive on certain flip-flops). A change to the masks for the second diffusion has been made to correct this problem. The new masks are due on or before October 1. Material has been started through the first diffusion, and will be ready for these new masks when they arrive.

Additional $\div 10$, $\div 12$, $\div 256$ material is presently being processed, and it is expected that the present lots of material should be sufficient for these particular array types.

(2) 100VA

No activity.

B. Current Problems and Corrective Action

No problems.

C. Work to be Performed During Next Reporting Period

1. System

a. 75VA

- (1) Complete fabrication of first production model inverter.
- (2) Begin electrical evaluation of first production model.

b. 100VA

- (1) Continue circuit design.

2. Power Transistors

a. 75VA

- (1) Continue building L-163's and L-164's.

b. 100VA

- (1) Obtain masks and start initial diffusion runs.

3. I/C Arrays

a. 75VA

- (1) Complete processing of ripple counter material. Expedite processing of new Johnson counter arrays, and complete delivery of these arrays.

Table A-1 Parts List - 75 VA Integrated Static Inverter
 (Originally Issued March 1, 1966)

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufac-turer</u>	<u>Date of Change</u>	<u>Comments</u>
Q1-Q7	L-163, Dual Power NPN Darlington Transistor, 6 Pin Stud Package	TI		Developmental Item
Q8	L-164, Dual Power NPN-PNP Transistor, 6 Pin Stud Package	TI		Developmental Item
Q9	2N3838, Dual PNP-NPN Transistors in TO-89 Package	TI		
Q10	2N3044, Dual NPN Transistors in TO-89 Package	TI		
Q11-Q13	2N3038, Transistor in TO-50 Type Package	TI		
N1	L-169, Integrated Circuit Variable Duty Cycle One-Shot; Mask Modification of SN5380	TI		Developmental Item
N2	SN523A, Integrated Circuit Differential Amplifier	TI		
N41	L-166, Integrated Circuit 8 Stage Ripple Counter Array	TI		Developmental Item
N42	L-165, Integrated Circuit 6 Stage Johnson Counter and Toggle Flip-Flop Array	TI		Developmental Item

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufacturer</u>	<u>Date of Change</u>	<u>Comments</u>
NA3	L-168, Integrated Circuit: • 10	TI		Developmental Item
NA4	L-167, Integrated Circuit: • 12	TI		Developmental Item
TXCO	2.4576 mc Temperature Compensated Crystal Oscillator	Bendix		Developmental Item; Weight ≈ .71 oz.
C1-C3	K1G205J-H1, 2uf, 100VDC, ±5%	Elpac	4-1-66	
	Polycarbonate Capacitor			
C4-C6	K1G333K-D2, .033uf, 100VDC, ±10%	Elpac	7-1-66	
	Polycarbonate Capacitor			
C7-C8	186P33491T15 .33uf 100VDC, ±10%	Sprague	7-1-66	
	Metal Clad Capacitor			
C9	202D108X0050A5, 50VDC, 1000uf, ±20%, Tantalum Capacitor	Sprague		
C10	202D357X9150A5, 150VDC, 350uf, ±10%, Tantalum Capacitor	Sprague		Weight ≈ 5.5 oz.
C11	202D198X9015A2, 15VDC, 1900uf, ±10%, Sprague	Sprague		

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufacturer</u>	<u>Date of Change</u>	<u>Comments</u>
C11	Tantalum Capacitor			Weight ≈ 3.0 oz.
C12, C16	SCM396BP010C2, 39uf, 10VDC, ±10%	TI	7-1-66	
C13	SCH06F221M, 220pf, 200VDC, ±20%	Scionics		Ceramic Capacitor

Parts List - 75 VA Integrated Static Inverter

] Table A-1 (Continued)

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufac-turer</u>	<u>Date of Change</u>	<u>Comments</u>
C14	K6G563G-G1, .056uf, 600VDC, ±2%, Polycarbonate Capacitor	Elpac	5-1-66	
C15	SCM227HPO10D2, 220uf, 10VDC, ±10%, Tantalum Capacitor	TI		
C17	SCM335FP015A4, 3.3uf, 15VDC, ±20%, Tantalum Capacitor	TI	6-1-66	
C18	SCM685BPO35D2, 6.8uf, 35VDC, ±10%, Tantalum Capacitor	TI	7-1-66	
Z1	1% 1N753, 6.2V, Breakdown Diode, Moly/G Glass Package	TI	4-1-66	Selected from 1N753 family
Z2, Z5	1% 1N752, 5.6V, Breakdown Diode, Moly/G Glass Package	TI	4-1-66	Selected from 1N752 family
Z3	1N969B, 22V, 5% Breakdown Diode, Moly/G Glass Package	TI		
Z4	Deleted		7-1-66	
D1	1N3890, 100V, 12 AMP Fast Recovery Rectifier, DO-4 Type Package	TI		
D2, D3, D10, D4	TI-252, 50V, 40ma Diffused Silicon Mesa Diode, Micro/G Package	TI	5-1-66	
D5, D6	Deleted		7-1-66	

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufacturer</u>	<u>Date of Change</u>	<u>Comments</u>
D7, D8	G130 Stabistor, Silicon Forward Conductance Diode, Moly/G Glass Package	TI	4-1-66	
D9	G129 Stabistor, Silicon Forward Conductance Diode, Moly/G Glass Package	TI	4-1-66	
DA1	TRIXD29, 30V, Dual 10 Array, TO-84 Type Package	TI	7-1-66	
R1 - R3	RW69V201, 2000Ω, 3W, Wirewound Resistor	Sprague		
R4-R6	CR-1/8, 442Ω, 1/8W, 1%, Carbon Film Resistor	TI	5-1-66	
R7	CR-1/8, 143Ω, 1/8W, 1%, Carbon Film Resistor	TI	4-1-66	
R8	CR-1/8, 750Ω, 1/8W, 1%, Carbon Film Resistor	TI		
R9, R10	3260H-1-101, 100Ω, Trimpot	Bourns		

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufacturer</u>	<u>Date of Change</u>	<u>Comments</u>
R11	CR-1/4, 150Ω, 1/4W, 1%, Carbon Film Resistor	TI		
R12	CR-1/4, 200Ω, 1/4W, 1%, Carbon Film Resistor	TI		
R13	CR-1/8, 100K, 1/8W, 1%, Carbon Film Resistor	TI		
R14	CR-1/8, 150Ω, 1/8W, 1%, Carbon Film Resistor	TI		
R15, R20, R21	CR-1/8, 3.92K, 1/8W, 1%, Carbon Film Resistor	TI		
R16	CR-1/8, 4.99K, 1/8W, 1%, Carbon Film Resistor	TI		
R17	CR-1/8, 2.74K, 1/8W, 1%, Carbon Film Resistor	TI	4-1-66	
R18	CR-1/8, 14.3K, 1/8W, 1%, Carbon Film Resistor	TI		
R19	MC65 T-2, 309Ω, 1/2W, 1%, Metal Film Resistor	TI		5-1-66

Parts List - 75 VA Integrated Static Inverter

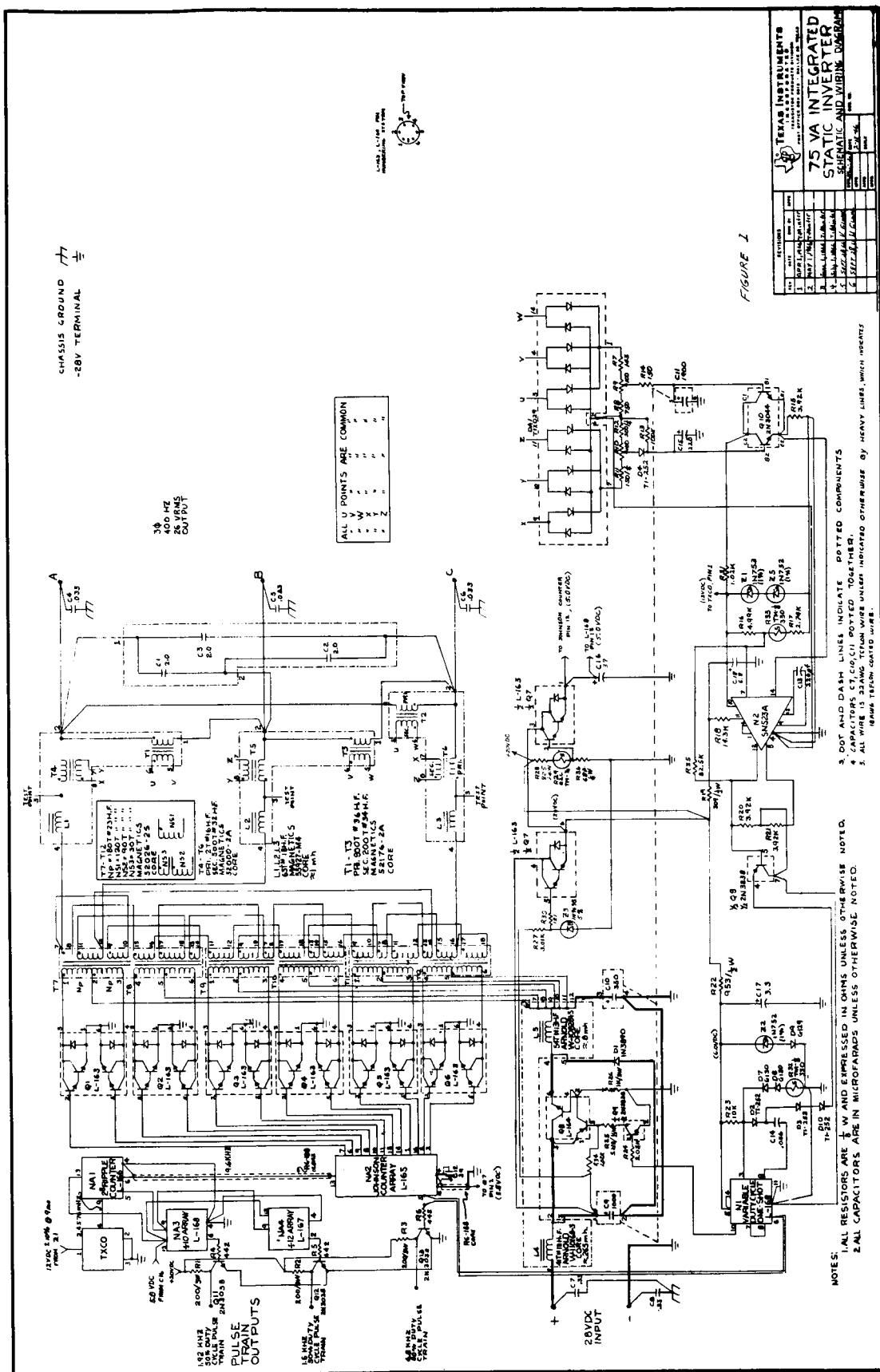
Table A-1. (Continued)

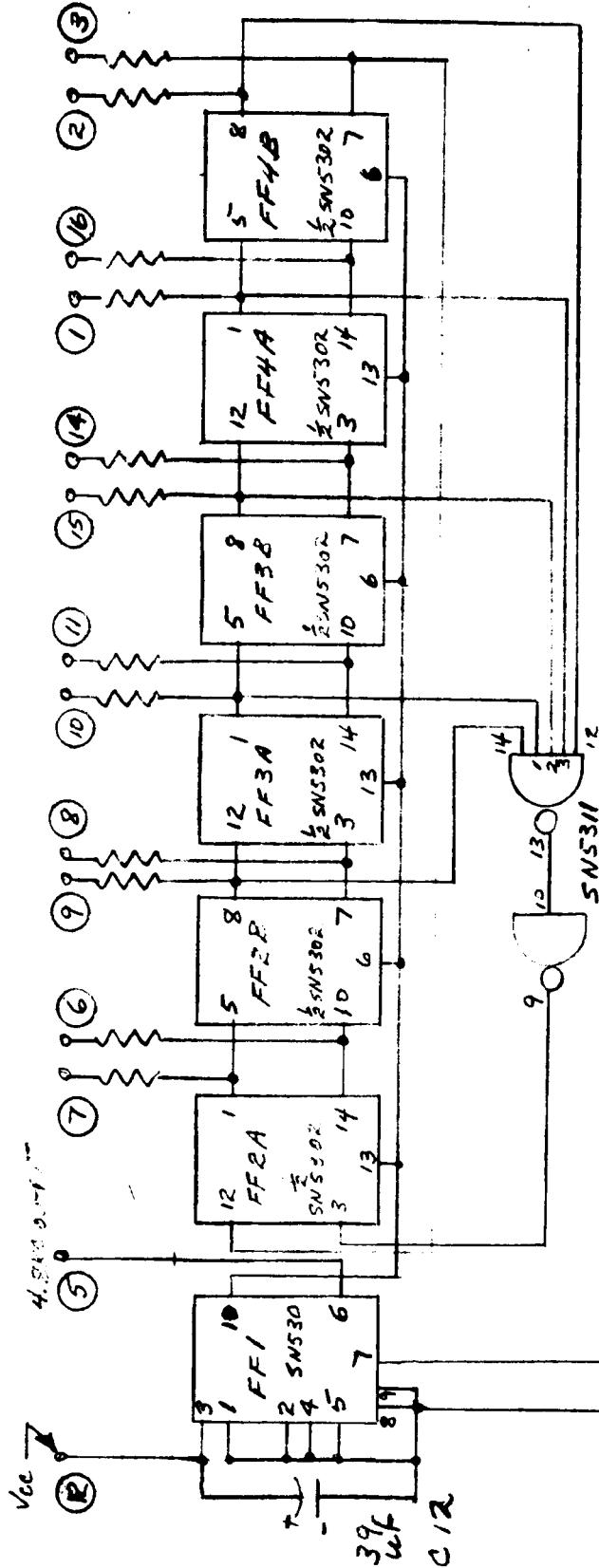
<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufac-turer</u>	<u>Date of Change</u>	<u>Comments</u>
R22	MC65 T-2, 953Ω, 1/2W, 1%, Metal Film Resistor	TI	5-1-66	
R23	CR-1/8, 10K, 1/8W, 1%, Carbon Film Resistor	TI		
R24	CR-1/8, 2.05K, 1/8W, 1%, Carbon Film Resistor	TI	7-1-66	
R25	CR-1/2, 5.23K, 1/2W, 1%, Carbon Film Resistor	TI	7-1-66	
R26	RW69V102, 1K, 3W, Wirewound Resistor	Sprague		
R27	CR-1/8, 3.01K, 1/8W, 1%, Carbon Film Resistor	TI		
R28	CR-1/4, 825Ω, 1/4W, 1%, Carbon Film Resistor	TI	7-1-66	
R29	820Ω, *5%, TM-1/4, Sennistor	TI	7-1-66	
R30	CR-1/8, 121Ω, 1/8W, 1%, Carbon Film Resistor	TI	7-1-66	
R31, R34	CR-1/8, 1.02K, 1/8W, 1%, Carbon Film Resistor	TI	5-1-66	
R32, R33	330Ω, *5%, TM-1/8, Sennistor	TI	4-1-66	
R35	CR-1/8, 82.5K, 1/8W, 1%, Carbon Film Resistor	TI	6-1-66	
R36	CR-1/4, 750Ω, 1/4W, 1%, Carbon Film Resistor	TI	7-1-66	

Parts List - 75 VA Integrated Static Inverter

[Table A-1 (Continued)]

<u>Component Designation</u>	<u>Description of Components</u>	<u>Manufacturer</u>	<u>Date of Change</u>	<u>Comments</u>
L1-L3	AC Choke, ≈ 1mh, 63 Turns, #18 H.F. Core: Magnetics 55927-M4 Powdered Iron Toroid	-		Unpotted Weight of Each Choke ≈ 2.0 oz.
L4	DC Choke, ≈ .265mh, 41 Turns, #13 H.F. Core: Arnold W110168-3 Powdered Iron Toroid	-	4-1-66	Unpotted Weight of Choke ≈ 5.5 oz.
L5	DC Choke, ≈ .8mh, 54 Turns, #13 H.F. Core: Arnold W-108281-3 Powdered Iron Toroid	-	4-1-66	Unpotted Weight of Choke ≈ 10.6 oz.
T1-T3	Voltage Sense Transformers, Cores: Magnetics 52176-2A , Tape Wound Toroids, PRL . 900T #36 H.F., SEC. 200T #34 H.F.	-		Unpotted Weight of Each Trans- former ≈ .47 oz.
T4-T6	Current Sense Transformers, Cores: Magnetics 52000-2A Tape Wound Toroids, PRL . 2T #16 H.F., SEC. 500T #32 H.F.	-		Unpotted Weight of Each Trans- former ≈ .44 oz.
T7-T12	Power Transformers, Cores: Magnetics 52026-2S Tape Wound Toroids, PRL . 180T, SEC. NS1 = 120T, NS2 = 90T, NS3 = 30T. All Wire is #23 H.F.	-		Unpotted Weight of Each Trans- former ≈ 4.3 oz.
X1	G-663 Thermistor (NASA Part #50M10346)	FEIC		Not shown or dis- cussed elsewhere in this report.





THE PIN AND EIGHT PACKAGE CIRCUIT

THE PIN 11 IS EACH PACKAGE TO Vcc (NOTE FF1 IS A 10-PIN PACKAGE)
 THE PINS 5, 6, 7 & 11 OF SN5311 & PIN 11 OF ALL SN5302'S TO Vcc.
 ALL RESISTORS ARE T1 CR 40453 2Ω, 1Ω CARBON FILM RESISTORS
 THE PINS 2 & 9 ON SN5302'S TO GND
 CIRCLED NUMBERS ARE OUTPUT TERMINALS - THE NUMBERS CORRESPOND
 WITH THOSE ON THE SINGLE CHIP PACKAGE
 SERIES 53 JUNCTION COUNTER

F16 Circuit 2

10-3-66